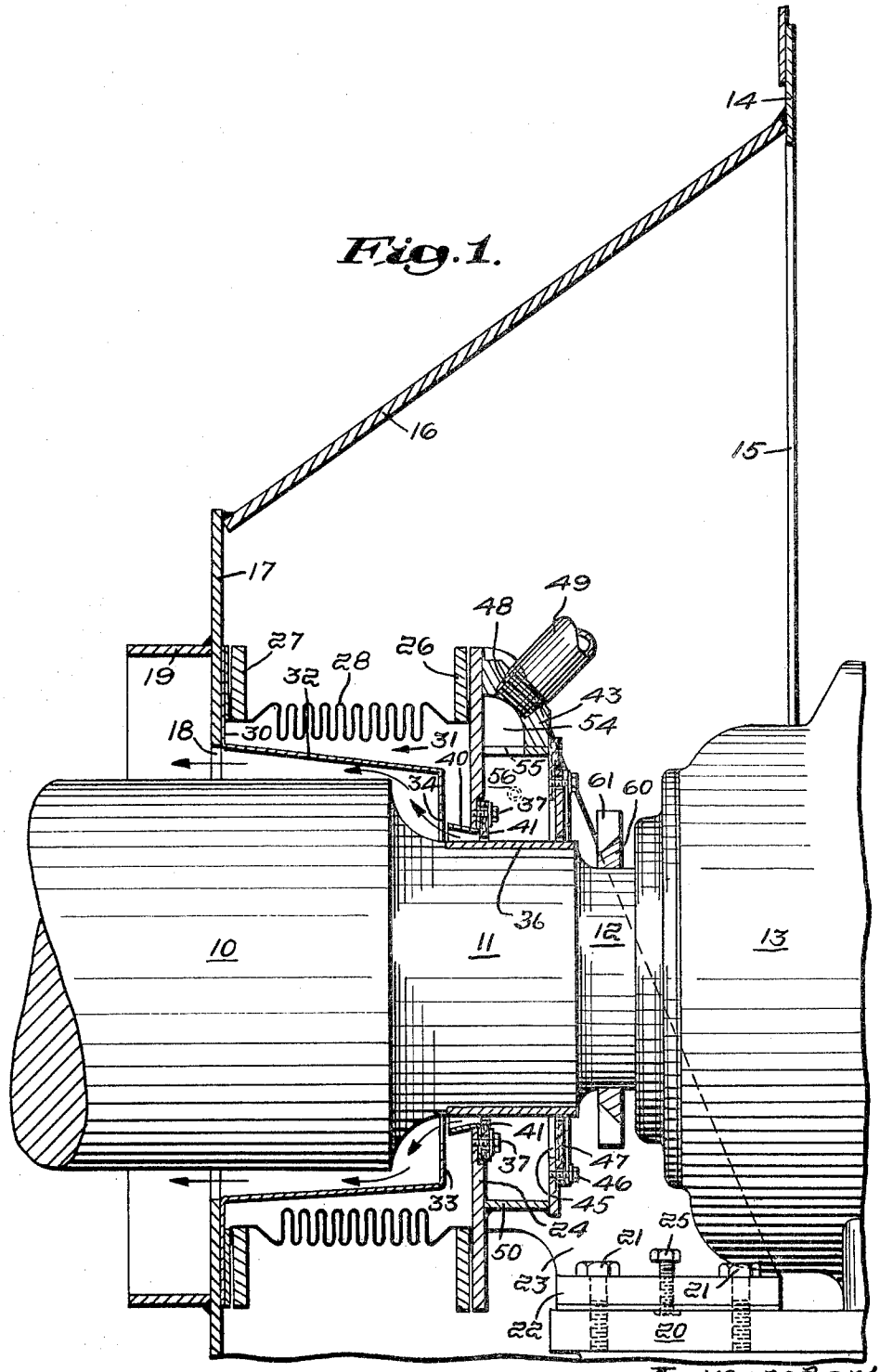
Sept. 13, 1966 J. H. HOFFMAN 3,272,516

PRESSURIZED SEALS FOR THE SHAFTS OF FANS

Filed Dec. 31, 1963 2 Sheets-Sheet 1

Fig. 1.



Inventor:
Joseph H. Hoffman,
by Robert J. Palmer Attorney

Sept. 13, 1966 J. H. HOFFMAN 3,272,516

PRESSURIZED SEALS FOR THE SHAFTS OF FANS

Filed Dec. 31, 1963 2 Sheets-Sheet 2

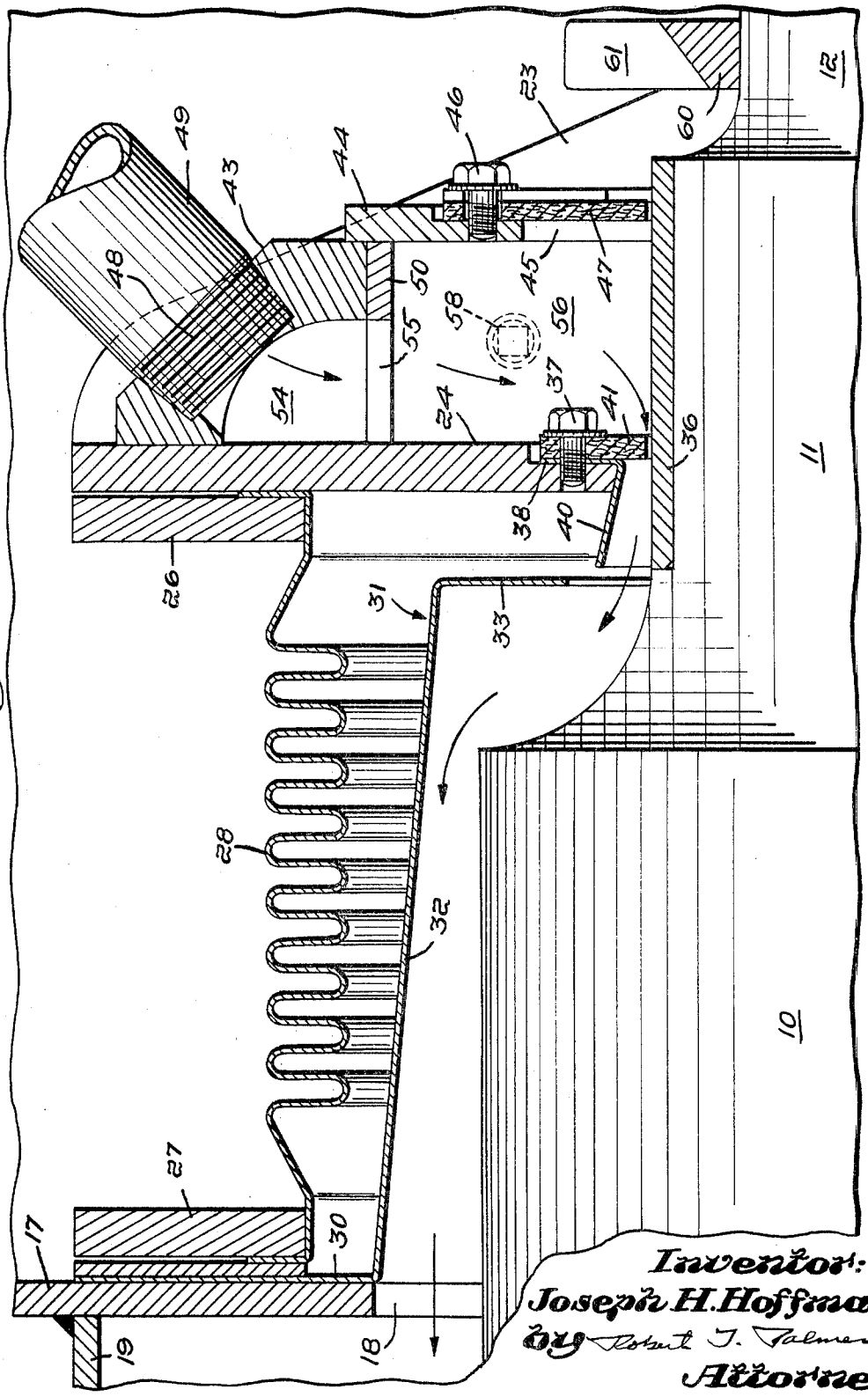


Fig. 2.

Inventor:
Joseph H. Hoffman,
By Robert J. Palmer
Attorney

United States Patent Office

3,272,516

Patented Sept. 13, 1966

3,272,516

PRESSURIZED SEALS FOR THE SHAFTS OF FANS

Joseph H. Hoffman, Norwood, Mass., assignor to Westinghouse Electric Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

Filed Dec. 31, 1963, Ser. No. 334,772
8 Claims. (Cl. 277—4)

This invention relates to pressurized seals for the shafts of fans.

Heavy duty fans usually have bearings around their shafts exterior their casings. Such fans may handle very hot or corrosive or toxic gases which should not be permitted to escape through clearance openings around their shafts into apparatus rooms where the fans are located. Seals through which compressed air is supplied into the fan casings at the clearance openings are used to prevent the escape of gas handled by the fans through such openings. One such seal is disclosed in the U.S. Patent No. 3,081,096 of R. V. Woodbury.

An object of this invention is to provide a pressurized seal with cooperating parts which move relative each other during expansion of a fan casing caused by heated gas.

Another object of this invention is to prevent foreign matter entrained in a gas handled by a fan from entering a pressurized seal around the shaft of the fan.

Other objects of this invention are to simplify, reduce the cost of, and reduce the maintenance of pressurized seals for the shafts of fans.

This invention will now be described with reference to the annexed drawings, of which:

FIG. 1 is a fragmentary side view, in section, of a seal embodying this invention, and

FIG. 2 is an enlargement of the upper portion of FIG. 1.

A fan shaft has a larger diameter portion **10** to which the fan rotor which is not shown is attached; has an outer reduced diameter portion **11**, and has a still further outer portion **12** with a further reduced diameter which extends into a bearing which is not shown, in a bearing housing **13**. A casing end wall **14** has a circular opening **15** around the inner end of the housing **13**, and has welded thereto around the opening **15**, a wall **16** shaped as a frustum of a cone, and which converges inwardly into the fan casing, centrally around the axis of the shaft. Welded to the inner end of the wall **16** is a vertically extending plate **17** having a central opening **18** around the shaft portion **10**. An annular plate **19** is welded to the inner surface of the plate **17** centrally around the shaft portion **10**, and the opening **18**. Attached by bolts **21** to the upper side of horizontally extending base **20** of the bearing housing **13** is a plate **22** to which is attached the outer end of a seal support **23** to the inner end of which is attached a circular plate **24** having a clearance opening around the shaft portion **11**. Bolts **25**, one of which is shown by FIG. **1**, are leveling bolts.

Clamped between a ring **26** attached to the inner side of the plate **24** and a ring **27** attached to the outer side of the plate **17** by bolts which are not shown, are vertically extending ends of a flexible bellows **28**. Also clamped between the ring **27** and the plate **17** is vertically extending inner end portion **30** of a sleeve **31** which has an intermediate portion **32** shaped as a frustum of a cone, and which has a vertically extending outer end portion **33** with a circular opening **34** around the shaft portion **11**. The sleeve portion **32** diverges from its end portion **33** towards its inner end, and at its inner end has a diameter equal to that of the opening **18** in the plate **17**.

A conventional wear sleeve **36** is attached to the outer portion of the shaft portion **11**, and extends through the clearance opening in the plate **24**. Attached to the outer side of the plate **24** in a recess therein around the clearance opening therein, by bolts **37**, is vertically extending outer end portion **38** of a sleeve **40** which diverges towards the opening **34**, and has at its inner end a diameter smaller than that of the opening **34** so that the inner end of the sleeve **40** can move freely into and out of the opening **34**. Also attached by the bolts **37** to the plate **24** is a conventional, hard asbestos seal ring **41**.

Attached to the outer side of the plate **24** is the inner side of a boss **43** which has an outer side to which is attached a ring **44** having a central clearance opening **45** around the outer end portion of the sleeve **36**. Attached to the outer side of the ring **44** in a recess therein, by bolts **46** is a ring **47** similar to the ring **41**. The rings **41** and **47** have vertically extending slots for permitting adjustment of their clearances around the sleeve **36**. The boss **43** is tapped to receive threaded end **48** of tube **49** which is connected to a conventional source of compressed air which is not shown.

An annular plate **50** extends between the inner edge of the boss **43** and the inner side of the plate **44**. The boss **43** has an air chamber **54** connecting through opening **55** in the plate **50** with an air chamber **56** bounded by the seal rings **41** and **47**, adjacent portions of the plate **24** and the ring **44**, and the sleeve **36**. A connection **58** is provided for a pressure gauge.

A deflector ring **60** is attached to the shaft portion **12** between the bearing housing **13** and the seal ring **47**, and has fan blades **61** thereon for deflecting seal air escaping from the shaft seal between the sleeve **36** and the ring **47** from the bearing in the housing **13**, this being conventional.

Operation

In operation, compressed air supplied through the tube **49** passes through the chambers **54** and **56** and through the clearance space between the seal ring **41** and the sleeve **36** into the space between the flared sleeve **40** and the sleeve **36**, and passes from the latter space through the opening **34** into the space between the flared sleeve **31** and the shaft portion **10**. The compressed air then passes from the latter space through the opening **18** and ring **19** into the fan casing. The smaller, flared sleeve **40** acts as a high velocity nozzle discharging a jet of compressed air into the larger flared sleeve **31** which acts as a lower velocity nozzle discharging a lower velocity jet of compressed air into the fan casing. The bellows **28** permits relative movement of the plate **17** attached through the wall **16** to the casing wall **14**, and the plate **24** attached through the support **23** and the plate **22** to the bearing housing **13**, and prevents any slight volume of air that might escape at the inner end of the flared sleeve **40**, from leaving the seal.

The fan may handle heated air at a temperature as high as 800° F., so that the casing may expand after start up, and move the flared sleeve **31** towards the flared sleeve **40**. When this happens, the outer end of the flared sleeve **31** moves outwardly past the inner end of the flared sleeve **40** without contact between the flared sleeves as a result of the opening **34** having a larger diameter than that of the inner end of the flared sleeve **40**. The flexibility of the bellows **28** permits such movement.

Dust, dirt and any other foreign particles entrained in the gas moved by the fan, are prevented from entering the seal by the jet action of the flared sleeves **40** and **31**. The annular ring **19** at the inner side of the plate **17**, prevents any large accumulation of dirt from dropping on the fan shaft at the exit of the flared sleeve **31**.

What is claimed is:

1. A pressurized seal for a shaft of a fan having a casing wall through which the shaft extends, comprising a pair of vertically extending, spaced apart plates spaced inwardly of said wall, an inwardly flared, open ended sleeve around and spaced from said shaft and attached to the innermost of said plates, said innermost plate having an opening around said shaft aligned with the opening in the inner end of said sleeve, a smaller, inwardly flared, open ended sleeve around and spaced from said shaft and attached to the outermost of said plates, and with its inner end adjacent to the outer end of said first mentioned sleeve, said inner end of said smaller sleeve having a smaller diameter than said outer end of said first mentioned sleeve, a seal ring around said shaft and attached to said outermost plate adjacent to the outer end of said smaller sleeve, a third, vertically extending plate spaced outwardly of said outermost plate and having an opening around said shaft, a second seal ring around said shaft and attached to said third plate, means including said third and outermost plates and said seal rings, forming an air chamber around said shaft, and means for supplying compressed air into said chamber.

2. A seal as claimed in claim 1 in which there is a flexible bellows around said first mentioned sleeve and the inner portion of said smaller sleeve and attached to said plates of said pair.

3. A seal as claimed in claim 2 in which said shaft has a bearing housing spaced outwardly from said third plate, in which means is provided for supporting said third and outermost plates from said housing, and in which means is provided for supporting said innermost plate from said wall.

4. A seal as claimed in claim 1 in which said shaft has a bearing housing spaced outwardly from said third plate, in which means is provided for supporting said third and outermost plates from said housing, and in which means is provided for supporting said innermost plate from said wall.

5. A seal as claimed in claim 4 in which there is provided an annular ring attached to the inner side of said innermost plate around said opening in said innermost plate.

6. A seal as claimed in claim 1 in which there is provided an annular ring attached to the inner side of said innermost plate around said opening in said innermost plate.

7. A seal as claimed in claim 6 in which there is provided a flexible bellows around said first mentioned sleeve and the inner portion of said smaller sleeve and attached to said plates of said pair.

8. A seal as claimed in claim 7 in which said shaft has a bearing housing spaced outwardly from said third plate, in which means is provided for supporting said third and outermost plates from said housing, and in which means is provided for supporting said innermost plate from said wall.

References Cited by the Examiner

UNITED STATES PATENTS

2,859,053	11/1958	Phelps	277—174
3,039,779	6/1962	Laird	277—70 X
3,081,096	3/1963	Woodbury	277—4

SAMUEL ROTHBERG, *Primary Examiner.*